The DESCRIPTION and USE OF THE *Double-Horizontal-DIALL.*

BEING

Of excellent Use to those that live in Remote Towns or Houses, to know the Hour of the Day, for it Self is the Rule to set it Self.

Whereunto is annexed,

The PERPETUAL ALMANACK,

WITH

A plain Description of the Use of that, *viz.* how to find the Day of the Week, the Day of the Month, the Dominical Letter, the Leap-year, the Epact, and consequently the Age of the Moon, and High-water at *London-Bridge.*

The Print of this Dial and Almanack pasted on a Board and fitted with a Cock, is sold at reasonable price by *Adam Ordway* at the *Coffee-House* in *Alderſgate-ſtreet*, in *Maidenhead-Court.* Also the Print of a *Double Quadrant.*

LONDON, Printed by *William Godbid*, in the Year 1662.

The Description and Use of the

GENERAL

Double Horizontal Dial,

ON A

RING

OF excellent Use to those that live in Remote Towns or Houses, to know the Hour of the Day, for Self-same Rule serves all Parts of the Habitable World.

The Perpetual Almanack

WITH

A plain Description of the Use of that, and how to find the Day of the Month, the Dominical Letter, the Leap-years, the Epact, and consequently the Age of the Moon, and high water at *London-Bridge*.

The Price of this Dial and Almanack pasted on a Board and Frame with a Cock, is sold at reasonable rates by *Samuel Oxlade* at the *Coffee-House* in *Salisbury-Court* in *Fleet-street*, in *Mitre-Alley* Court. Also the Price of a *Double Quadrant*.

LONDON: Printed by *William Godbid*, in the Year 1664.

W. day	S	M	T	W	T	F	S
Dom. l.	d	c	b	a	g	f	e
Leap y.	68	80	64	76	60	72	84
	96	8	92	4	88	700	12
Epact.	26	9	12	25	28	11	23
	6	18	22	4	7	20	3

Month.	1	6	3	8	5	7	12
	9	0	11	0	2	10	4
Days.	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	0	0	0	0

Thirty days hath *September*, *April*, *June*, and *November*;
February Twenty eight alone, all the reſt Thirty and one.

To the Reader.

Courteous Reader,

I Have observed the Genius of many men Runing out towards the ingenious practise of the Mathematicks: *But because the Description of the Rules are laid down in such hidden Phrases, it hath disheartned many; but in the Description of the Uses of these* Mathematical *Projections, I have endevoured to be so plain, that the meaneſt capacity may understand them: But if it hath happened, that I have been more brief or hidden then I intended, You may command him that is willing to serve You according to his weak Abilities.*

ADAM ORDVAT.

THE first thing I shall speak of in Reference to my Print of the *Double-Horizontal-Diall*, is to know the day of the Month, by the Tables on each side of the Cock or Gnomen, for the Day of the Month is principally to be known. For by that you may on the *Double-Horizontal-Diall* the Sun not shining, know First the Declination of the Sun; Secondly, the Degree of the Sun in the Ecliptick; Thirdly, the Suns rising and setting; Fourthly, the Length of the day and night; Fifthly, how many Hours or Minutes the Sun riseth or setteth from the East or West point, *viz.* 6 a Clock, or the Equinoct point; and Sixthly, at what Hour and Minute the Sun will be East or West in this our Latitude, on this or that Day of the Month. And by the Sun shining you may know the hour of the Day to a Minute; and also the Suns Azumith at one and the same time.

First, *How to find the Day of the Month.*

On each side of the Cock are Tables of Collumes;

lumes; the first is that on the left hand, and shows in the uppermost Collume the Week-day, that you must call all the Days by, marked in the second Table of Months and Days. Here you must note that because this little Table is for 54 years, and so consequently for ever, therefore something must be remembred, and that is the years between each Leap year. As for Example; over the Leap-year 1660 is the Letter T. 60 signifies 1660. and T signifies *Thursday*, now then if in the year 1660 the Dayes in the right hand Table must be called all of them *Thursday*, then in the Year 1661 they must be called *Friday* consequently; and in the year 1662 they must be called *Saturday*; and the year 1663 *Sunday*, the year 1664 *Monday* and *Tuesday*, because it is Leap-year, as you may see it noted in the Collums of Leap-year, for indeed there is no other years but Leap-years noted there; now you must note, when this changing from *Monday* till *Tuesday* is, why it is always on the 29 day of *February*, so that because *February* hath a day more in the Leap-year then other years, 'tis put at the last day of *February*, which last day is the first day of the Leap-year alway, and the first of *March* is the first day of the years that are not Leap-years: So the first day of the Leap year, namely the 29 of *February* is *Monday*, and the first day of *March* is *Tuesday*, and so it comes to Leap from *Monday* to *Tuesday*, so that in the Leap-year 1664 all the Days must be called *Tuesdays*,

in 1665 called *Wednesdays*, and 1666 *Thursdays*, in 1667 *Fridays*, and 1668 the first day of that year, which is always the 29 of *February* as I said before, must be called *Saturday*; and then the first of *March* must be called *Sunday* as in the year 1668, Then if the first day be *Sunday*, the second is *Monday*, the third *Tuesday*, the fourth *Wednesday*, the fifth *Thursday*, and so on; this being well considered, the whole Mystery is unfolded, and the day of the Month easily known for ever. As for Example; in this year 1662 all the days in the Right hand Table, under the Months are to be called *Saturdays*, because in the year 1660 the first day of *March* was *Thursday*, as you may see by the Colum of Leap-years; for over 60 is T. now then if in the year 1660 the days of the year under the Months on the right hand Table be *Thursdays*, then consequently the year 1661 must be *Fridays*, and 1662 they must be *Saturdays*. Thus having found the Week-day, to call the Days by, the day of the Month is easily found; as for Example, under the first and ninth Month, that is, *March* and *November*, *Saturday* is the first day, the 8, the 15, the 22. the 29. So also under the 6 Month which is *August*, *Saturday* is the 2, the 9, the 16, the 20, the 30. So also under the 3 and 11 Month, *Saturday* is the 3 day, the 10, the 17, the 24, the 31 of both these Months, namely *May* which is the 3 Month, and *January* which is the 11 Month. Thus having

found all the *Saturdayes* in all the Months, 'tis easie to find the rest, for if *Saturday* be the first day of the first Month, which is *March*, then *Sunday* must be the 2, *Munday* the 3, *Tuesday* the 4, *Wednesday* the 5, *Thursday* the 6, *Friday* the 7, and *Saturday* the 8 as before, and *Sunday* the 9, and thus by knowing the day of the Week, you know the day of the Month, and by knowing the day of the Month, you may know the day of the Week; as for example, in this year 1662, I would know what day of the Week St. *Thomas* day falls on, which is alway the 21 of *December*, I look in the Colume of the dayes under the 10 Month, and there I find *Saturday* the 6 day, *Saturday* the 13, *Saturday* the 20. now if *Saturday* be the 20. then St. *Thomas* day falls on a *Sunday*; again I would know what day of the Week *Christmas-day* falls on, which is always on the 25 of *December* or 10 Month: I look as before, *Saturday* is the 6, the 13, the 20, the 27, then if *Saturday* be the 27, as you may see it is, then is *Friday* the 26, and *Thursday* the 25 of *Christmas-day*; having shown how to find the day of the Month which is the ground work on which dependeth the knowledge of the Suns declination, length and shortnesse of the day and night, the Hour and Minute of the Sun rising and setting, the degree of the Sun in the Ecliptick, how many Hours or Minutes the Sun riseth or setteth from the East or West, upon the *Double-Horizontal-Dial*.

And First to find the degree of the Suns Declination.

There is right against the 10 day of *March* and the 13 of *September*, a large pricked Line which is called the Equinoctial, and marked on the 12 a Clock Line toward the Center, with 5, 10, 15, 20 degrees of North Declination, and towards the Circumference with 5, 10, 15, 20, unto 23 ½ of South Declination, and ends with the parrallel of the 11 of *December*, these 23 degrees and a half, are signified by 23 circular Lines, so the Line marked with 20, begins about the 14 of *July*, and ends about the 10 of *May*, showing that the Sun is 20 degrees from the Equinoctial, the 10 of *May*, and the 14 of *July*, and it is called North Declination; that Line of the 10 degree of North Declination, beginneth about the 17 of *August*, and goeth round, and endeth about the 5 day of *April*: But about the 10 of *March* there begins the Line of the Equinoctial, and follow it round, and it ends about the 13 of *September*. When the Sun is in this Line, the day and night are said to be of equal length over all the World, the Sun those two dayes hath no declination, as you may see it marked on the 12 a Clock or Meridian Line. Then again the 25 day of *September* the Sun hath 5 degrees of declination, that Line followed, ends about the 25 day of *February*; this is called South declination, the Horizon meeting with these Lines of declination, and cutting them

them shorter and shorter, till the 11 of *December*, where the Declination is 23 degrees and 30 Minutes of South Declination from the Equinoctial, and thus as in a Glasse you may behold the Suns daily motion through the 12 Signs of Heaven, which is the next thing I will treat of.

Secondly, *To find the Sign and Degree the Sun is in the Ecliptick.*

The Ecliptick Lines are drawn from the two Equinoctial points ♈ and ♎ and the middle of them touch on the two Tropicks ♋ and ♑, if you begin at the 10 day of *March*, and follow the inward circle toward the Cock, you will find the character of ♈ ♉ ♊ ♋ ♌ ♍ and ♎, begins about the 13 of *September*, and follow that and you find as is said before ♎ ♏ ♐ ♑ ♒ ♓ now the Line of Declination being followed with a pin from the day of the Month until you first touch the Ecliptick Line, and there you may perceive the degree the Sun is in on that day. As for example, the 30 day of *August* the Declination of the Sun is 5 degrees North, follow that Line and it cuts the 17 degree of ♍, and so of the rest.

Thirdly, *To know the Hour and Minute of Sun Rising and Setting.*

There are Hour-lines that cross the parallels of Declination, called parallels of the Meridian or 12 a Clock Line, these are marked with 4 & 5 & 5, 6 & 6, 7 & 7, 8 & 8, so on the other side marked with 8,7 & 7,6 & 6,5 & 5,4 & 4.

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by these Hour Lines you may see at what Hour and Minute the Sun riseth and setteth; as for example, the 12 day of *September* there is the Hour-line of 6, showing the Sun riseth at 6 of the Clock, follow the Equinoctial Line, and it ends about the 10 day of *March*, showing the Sun sets at 6 of the Clock; for there also is the Hour-Line of 6. A second Example; the 29 day of *August* the Sun riseth 30 Minutes or half an hour after 5 a Clock in the Morning; follow the parallel of declination, for that day which is about 5 degrees and 20 Minutes North, and that brings you to the 25 day of *March*, and shows the ☉ setteth at 6 a Clock & 3 Minutes.

Fourthly, *To know the length of the Day and Night.*

Double the hour and minute of Sun setting, and that is the length of the day, and double the hour and minute of Sun rising and that is the length of the night. As for Example; The 29 day of *August* the Sun setteth at 6 a clock, and 30 minute, the double of that, *viz.* 6 30 and 6 30 maketh 13 hours for the length of the day: then double the hour and minute of Sun rising, that is 5 30 and 5 30 or add them together, and it makes the length of the night, *viz.* eleven hours long.

Fifthly, *To know how many hours and minutes the Sun riseth and setteth from the East and West Point, or 6 a Clock.*

The East and West point is ♈ and ♎, or the point

point of 6 a Clock, and begins and ends on the Equinoctial Line, now when the Sun hath his greatest declination either North or South, which is 23 and ½, then the Sun Riseth two Hours and 20 Minutes from the East, and Setteth two Hours and 20 Minutes from the West. Now on the second day of *August* the Declination is 15 degrees, the Sun riseth at 4 a Clock, and 40 Minutes, that is, 1 Hour and 20 Minutes from the East; So also the 24 of *October* the Sun Riseth from the East 1 Hour and 20 Minutes.

Sixthly, *To know which is the Rising of the Sun from the Setting of the Sun.*

Here you must note that the time of the day on which the Sun riseth at one time of the year, is the Suns setting at the other time of the year: now to know the rising from the setting alway, that is, the Suns Rising that is joyned to the day of the Month, and that is the Sun setting at the other end of the Line. As for example; the 10 day of *March* the Sun riseth at 6 of the Clock, follow that Equinoctial Line, and it brings you to the 13 of *September*, and shows the Sun sets at 6 a Clock, now also on the 13 of *September*, the Sun riseth at 6 of the Clock, follow the line of declination, or more properly of no declination, to wit, the Equinoctial Line, and it ends at the 10 day of *March*, which shows the setting of the Sun to be 6 of the Clock the 13 of *September*, so that you see that which is the Suns rising at one time of the year, is the Suns setting at another.

Se-

Seventhly, *To know at what Hour or Minute the Sun is East or West.*

There is a little Circle placed in the Center of this Diall, marked with W E. Lay a strait Ruler strait along this Line of East and West, and where it cuts in the parallel of Declination, observe the Hour and Minute there, for that is the Hour and Minute of the Suns being in the East or West point. As for Example; the 13 day of *July* the parallel for that day is 20. if you lay a Ruler or Thred cross the Dial from 6 to 6, and follow the parallel of declination, and it cuts the Ruler about 10 Minutes after 7 of the Clock in the Morning, and 10 Minutes before 5 in the Afternoon; and then is the Sun due East or West, *&c.*

Now follow the Uses of the Double-Horizontal-Diall *when the Sun shineth, and first to know the Hour of the Day.*

Let the Dial be set in the Window, or some other level place where the Sun shineth, there will be two shadows, the one from the out uppermost part of the Cock, the other from the inward upright part of the Cock; this inward upright part, casteth a shadow upon those Hour Lines which cross the Parallels of Declination, the other out-side shadow casteth on the great out Circle of Hours, and it is divided into Minutes; the inward Hour into parallels of 10 Minutes crossing the parallels of Declination. Now observe the Rule to set

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the Dial Right, as you did before to know when the Sun will be true East and West, you minded the parallel of the day of the day of the Month cutting the Ruler: but in this you must mind the parallel of the day of the Month, cutting the inward upright shadow, as suppose upon 9 of the Clock the 13 of *September*; it must showe the same on the out Circle, if it stand right, that is to say, it must show the Hour and Minute in both places alike when it stands right, which you may quickly make it do, by moving it this or that way to make the Hour lines alike; when the Dial is set right, that it shows the Hour and Minute alike in both places, then that is the Exact hour of the Day, or then stands the Dial right, having the Hour to find the Azumith, the under upright shadow shows you the Azumith on the little Circle; as for Example, suppose the 30 of *September* the Sun shineth on 6 a Clock, on both the Hour Lines, then will the shadow cut in the little Circle about th: 90 degree, showing the Sun is 90 degrees or East from the South; again the 17 day of *July* at 7 a Clock in the morning, the Suns Azumith is 90 degrees from the South.

Now follow the rest of the uses belonging to the Perpetual-Almanack; *as first to know the Epact, and consequently the Age of the* D *and High-water at any Port.*

The Epact is a number of eleven to be added every year to make the common Lunar year e-

qual

qual with the solar, which is as some write 364 day, 6 hours, 22 seconds: So that if this number of 11 be added still, every first day of *March* to that which was the Epact before, 'twill give the Age of the ☽ which Age nor Epact ever exceedeth 30 days) but they must be cast away, and the Remain is the Epact and Age: now to find the Epact by the left hand Table, there is two Collums of Leap-years and two Collums of Epact, the uppermost of the one answering to the uppermost of the other. In the year 1660, on the first day of *March*, the Epact you see was 28, now then in 1661, ad 11 more to this 28, & that makes 39 but because the Epact never exceeds 30, therefore you must cast away 30 and the remain is 9, for the Epact in the year 1661 so must you do every year, except the Epact be 29, then the prime is 19, and both of them must begin again, the prime must be 1, and the Epact 11. which will happen in the years of Our Lord 1671, 1690, & 1709, every 19 years; to know the Epact in the year 1662, look in the Collums of the Epact in the year 1660, it was 28, and because 'tis 2 years since, I must add 2 elevens, or 22 to 28, that makes 50, cast out 30, and the remainder is the Epact, that is 20. in 1663 it will be 1 by adding 11, and casting away 30, then in 1664 you have it set down because 'tis Leap-year 12. So also as 12 being in the upper Collum of Epacts, is the Epact for the year 64, or 1664, which is the upper Collum of Leap-years, so is

leap the

the Epact 22 the under Collum, to signifie the Epact in the year 92 or 1692. thus by having the Epact, you have the age of the ☽ for the first day of *March*; as for example, the Epact in the year 1662 was 20, so was the ☽ 20 days old on the first day of *March*; now if you would know the ☽ age any other time, you must add to the Epact the number of the Month, and day of the Month, and that is the age of the ☽. As for example, on the 8 day of *February* 1661 Epact 9, the Month from *March* 12, the day of the Month 8, gives 29, now because 'tis *February* cast away but 29, and it shows 'tis new Moon on that day 7 days, and 9 hours added to the new ☽ makes the first quarter, 15 days after is full ☽, Example in 1662 Epact 20, 00 day of *April*, or 31 *March*, the Month from *March* is 2. you will find the ☽ is 22 days old; now if you would know when 'tis High-water at *London-bridge*, alway remember when the ☽ is no days, and when 'tis 15 days old, then 'tis high-water at *Londonbridge* at 3 a clock, or on the point of 6 then also 'tis high-water at *London-bridge*. Thus you may see that every 15 days motion of the Moon gives 12 hours, 5 days 8 hours, 2 days and a half gives 2 hours, 1 day & a quarter gives 1 hour more in alteration. As for example, if it be new or full ☽ to day at 3 a clock in the morning, 5 days hence when the ☽ is 5 days old, it will be high-water at 7 a Clock in the morning; the Exact motion of the Tides was never yet found out, nor is this very true, for the

Tides

Tides will vary according to the Bluſtrouſneſs & Scituation of the winds; for my part I am affected with the rarity of the invention of him that firſt found a Rule to be ſo brief, and of ſuch continuation, and ſo near the truth, that it is intelligible enough for thoſe that have but common ordinary uſe, ſo might I ſay concerning the *Double-Horizontal-Diall*, but for my part I will not find fault, till I can make a more certain Rule.

How to find out the Dominical Letter, or Lords Day Letter, or Sunday Letter.

I know very little uſe of this Sunday Letter, but only that it is a great and a large Regiſter for many thouſands of years, the reaſon is, becauſe the cycle of the ☉, the Golden number, the Epact, and Dominical Letter, and prime, are not all twice a like in many thouſands of years: But to find the Dominical Letter there is a Collum of Dominical Letters, & they are all Dominical Letters, for thoſe years under inſerted: as for example, over the year 1660 the Dominical Letter is G, then you muſt remember to ſay in 1661 F, in 1662 E, in 1663 D, in 1664 which is Leap-year C, from *January* till the 25 day of *February*, and then as you may ſee under the year 1664, there is B for the Sunday-Letter, ſo they ſucceed one another backward as you ſee g, f, e, d, c, b, a. But here you muſt note, the Dominical Letter and Prime doth change the firſt day of *January*, although the Epact change not until the firſt day of *March*.

FINIS.